CLAIMS

1. A layered low dielectric constant nanoporous material comprising:

   a first layer juxtaposing a substrate;

   a second layer that is nanoporous and juxtaposing the first layer; and

   an additional layer partially juxtaposing the second layer.

2. The material of claim 1, wherein the low dielectric constant material has a dielectric constant no more than 2.5.

3. The material of claim 1, wherein the first layer substantially comprises a continuous, non-porous polymer.

4. The material of claim 3, wherein the polymer is organic

5. The material of claim 4, wherein the polymer comprises polyarylene ether.

6. The material of claim 1, wherein the first layer substantially comprises a refractory ceramic material.

7. The material of claim 6, wherein the ceramic material is selected from the group consisting of silicon nitride, silicon oxynitride, and silicon carbide.

8. The material of claim 1, wherein the first layer substantially comprises a nanoporous material.

9. The material of claim 1, wherein the first layer substantially comprises an adamantane-based compound.

10. The material of claim 1, wherein the second layer substantially comprises a nanoporous polymer.

11. The material of claim 10, wherein the polymer comprises at least one of a polyarylene ether or an adamantane-based compound.

12. The material of claim 1, wherein the additional layer comprises an organic compound.

13. The material of claim 12, wherein the organic compound substantially comprises at least one of a polyarylene ether or an adamantane-based compound.

14. The material of claim 1, wherein the nanoporous material comprises voids having a mean diameter of less than 100 nanometers.

15. The material of claim 1, further comprising a layer of metal wire between the substrate and the first layer.

16. The material of claim 15, wherein the first layer is continuous.

17. The material of claim 15, wherein the metal wire is aluminum or copper.

18. A method of producing a layered low dielectric constant nanoporous material comprising:

depositing a first layer on a substrate;

depositing at least part of a second layer on the first layer;

treating the second layer to create nanoporosity; and

depositing at least part of an additional layer on the second layer.

19. The method of claim 18, wherein the substrate is a silicon wafer.

20. The method of claim 18, wherein the first layer is treated to create nanoporosity in the layer.

21. The method of claim 18, wherein the low dielectric constant structural layer has a dielectric constant no more than 2.5, the first layer comprises a polymer, the second layer comprises an organic polymer and said additional layer comprises a substantially organic polymer, and containing voids having a mean diameter of less than 100 nanometers.

22 The method of claim 18, wherein the low dielectric constant structural layer has a dielectric constant no more than 2.5, the first layer comprises polyarylene ether, the second layer comprises a polyarylene ether containing voids having a mean diameter of less than 100 nanometers and said additional layer comprises a polyarylene ether.

23 The method of claim 18, wherein the low dielectric constant structural layer has a dielectric constant no more than 2.5, the first layer comprises an adamantane-based compound, the second layer comprises a polyarylene ether containing voids having a mean diameter of less than 100 nanometers and said additional layer comprises at least one of a polyarylene ether or an adamantane-based compound.

24. The method of claim 18, wherein the low dielectric structural layer has a dielectric constant no more than 2.5, the first layer comprises a refractory ceramic material, the second layer comprises an organic polymer containing voids having a mean diameter of less than 100 nanometers, and the additional layer comprises a substantially organic polymer.

25. The method of claim 18, wherein the low dielectric structural layer has a dielectric constant no more than 2.5, the first layer comprises silicon nitride, the second layer comprises polyarylene ether containing voids having a mean diameter of less than 100 nanometers, and the additional layer comprises at least one of a polyarylene ether or an adamantane-based compound.

26. The method of claim 18, wherein the low dielectric structural layer has a dielectric constant no more than 2.5, the first layer comprises silicon nitride, the second layer comprises an adamantane-based compound containing voids having a mean diameter

of less than 100 nanometers, and the additional layer comprises at least one of a polyarylene ether or an adamantane-based compound.

27. The method of claim 18, wherein the nanoporosity is created by leaching an inorganic component from an organic component in the second layer.

28. The method of claim 25, wherein the inorganic component comprises silicon.

29. The method of claim 26, wherein the inorganic component is selected from the group consisting of a colloidal silica, a fused silica, a sol-gel derived monosize silica, a siloxane, and a silsesquioxane.

30. The method of claim 25, wherein the inorganic component comprises fluorine.

31. The method of claim 28, wherein the inorganic component is selected from the group consisting of HF, CF_4, NF_3, CH_zF_{4-z} and $C_2H_xF_y$, wherein x is an integer between 0 and 5, x + y is 6, and z is an integer between 0 and 3.

32. The method of claim 18, wherein the additional layer is formed from a solution containing a volatile component and an organic polymer that is deposited on the second layer, allowed to at least partially infiltrate the second layer, and heated to remove the volatile component and to cure the polymer.

33. The method of claim 30, wherein the additional layer comprises a solution of polyarylene ether dissolved in cyclohexanone.